

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings of claims in the application:

LISTING OF CLAIMS:

Claims 1-54 (cancelled)

55. (currently amended) A method for producing carbon nanotubes from a gas phase, ~~characterised in that the method comprises the following steps comprising:~~

producing pre-made aerosol catalyst particles by physical vapor nucleation of catalyst material or by solution droplet thermal decomposition of catalyst precursor ~~or by aerosolization from a powder or suspension;~~ and

~~using reacting said pre-made aerosol~~ catalyst particles and one or more carbon sources in a reactor to produce carbon nanotubes.

56. (currently amended) [[A]] The method according to claim 55, ~~characterised in that wherein~~ the catalyst precursor and/or the catalyst material contains one or more metals.

57. (currently amended) [[A]] The method according to claim 55, ~~characterised in that wherein~~ the catalyst particles are formed due to the nucleation of supersaturated

vapor wherein the vapor is evaporation from one or more resistively heated wires consisting of one or more metals or metal alloys, ~~due to metal or alloy laser ablation~~, due to metal or alloy arc, spark or electrostatic discharge, due to evaporation from a conductively heated metal or alloy or due to evaporation from radiatively heated metal or alloy.

58. (currently amended) [[A]] The method according to claim 57, ~~characterised in that~~ wherein the supersaturation is created by means of gas cooling by convective, conductive and/or radiative heat transfer and/or adiabatic expansion.

59. (currently amended) [[A]] The method according to claim 55, ~~characterised in that~~ wherein the catalyst particles are produced before the synthesis of carbon nanotubes in the reactor.

60. (currently amended) [[A]] The method according to claim 55, ~~characterised in that~~ wherein the catalyst particles are classified according to one or more particle properties.

61. (currently amended) [[A]] The method according to claim 60, ~~characterised in that~~ wherein the catalyst

particles are mobility-size classified, mass classified, solubility classified, reactivity classified, inertially classified, thermophoretically classified, diffusionaly classified, charge classified, crystallinity classified and/or gravitationally classified.

62. (currently amended) [[A]] The method according to claim 60, ~~characterised in that wherein~~ the catalyst particles are classified by a differential mobility analyzer or by a mass spectrometer.

63. (currently amended) [[A]] The method according to claim 55, ~~characterised in that wherein~~ the carbon source comprises a hydrocarbon.

64. (currently amended) [[A]] The method according to claim 55, ~~characterised in that wherein~~ the carbon source comprises methane, ethane, propane, acetylene, ethylene, benzene, toluene, o-xylene, p-xylene, 1,2,4-trimethylbenzene, 1,2,3-trimethylbenzene, C₁₅H₃₂, C₁₆H₃₄, C₁₇H₃₆, C₁₈H₃₈, methanol, ethanol, propanol, butanol, pentanol, hexanol, heptanol, octanol, acetone, methyl ethyl ketone, formic acid, acetic acid and/or carbon monoxide.

65. (currently amended) [[A]] The method according to claim 55, ~~e h a r a c t e r i s e d i n t h a t w h e r e i n~~ the method further comprises using one or more reagents.

66. (currently amended) [[A]] The method according to claim [[66]] 65, ~~e h a r a c t e r i s e d i n t h a t w h e r e i n~~ the reagent(s) is/are used for participation in a chemical reaction with one or more catalyst particle precursors and/or with one or more catalyst particles and/or with one or more carbon sources and/or with amorphous carbon deposited on carbon nanotubes and/or with carbon nanotubes.

67. (currently amended) [[A]] The method according to claim 65, ~~e h a r a c t e r i s e d i n t h a t w h e r e i n~~ the chemical reaction of the reagent(s) with catalyst particle precursor and/or with pre-made particles is/are used for promotion of carbon nanotube formation and/or in that the chemical reaction of reagent(s) with amorphous carbon is/are used for carbon nanotube purification and/or in that the chemical reaction of reagent(s) with the carbon nanotubes is/are used for carbon nanotube functionalization and/or carbon nanotube doping.

68. (currently amended) [[A]] The method according to claim 65, ~~e h a r a c t e r i s e d i n t h a t w h e r e i n~~ the reagent is an alcohol, H₂, H₂O, NO, CO₂, PH₃ and/or NH₃.

69. (currently amended) [[A]] The method according to claim 55, ~~characterised in that wherein~~ the method further comprises the following step:

using one or more additives to produce a composite carbon nanotube formulation.

70. (currently amended) [[A]] The method according to claim 55, ~~characterised in that wherein~~ the residence time, temperature and/or catalyst particle properties and/or catalyst particle concentration and/or reagent concentration and/or carbon source concentration histories in one or more reactors are controlled.

71. (currently amended) [[A]] The method according to claim 55, ~~characterised in that wherein~~ there are two or more existing catalyst particle supplies which are composed of particles of essentially similar sizes, compositions, concentrations, states and/or morphologies or are composed of two or more distinct sizes, compositions, concentrations, states and/or morphologies.

72. (currently amended) An apparatus for producing carbon nanotubes from a gas phase, ~~characterised in that the apparatus comprises comprising:~~

~~means for producing a device configured to produce pre-made aerosol catalyst particles by physical vapor nucleation of catalyst material or by solution droplet thermal decomposition of catalyst precursor or by aerosolization from a powder or suspension; and~~

one or more reactors for producing carbon nanotubes using said pre-made aerosol catalyst particles and one or more carbon sources.

73. (currently amended) [[An]] The apparatus according to claim 72, characterised in that wherein said means for producing device configured to produce said pre-made aerosol catalyst particles comprises one or more pre-reactors.

74. (currently amended) [[An]] The apparatus according to claim 72, characterised in that wherein said means for producing device configured to produce said pre-made aerosol catalyst particles comprises a hot wire generator.

75. (currently amended) [[An]] The apparatus according to claim 72, characterised in that wherein the apparatus further comprises one or more of the following:

one or more catalyst particle classifiers;
one or more carbon nanotube samplers;
one or more carbon nanotube classifiers;

one or more sources supplying energy to said means for producing device configured to produce said pre-made aerosol catalyst particles and/or to said reactor;

one or more ~~means~~ devices configured for introducing one or more reagents and/or additives to the ~~means for producing~~ device configured to produce said pre-made aerosol catalyst particles and/or to the reactor;

one or more aerosol samplers and/or classifiers extracting all or part of the carbon nanotube aerosol flow;

one or more aerosol samplers and/or classifiers extracting all or part of a composite carbon nanotube aerosol flow.

76. (currently amended) [[An]] The apparatus according to claim 72, characterised in that wherein the surface of the reactor and/or the ~~means for producing~~ device configured to produce said pre-made aerosol catalyst particles contain material included in one or more catalyst particles or in that the surfaces of the reactor and/or the ~~means for producing~~ device configured to produce said pre-made aerosol catalyst particles are saturated with material included in one or more catalyst particles.

77. (currently amended) [[An]] The apparatus according to claim 72, characterised in that wherein there are two

or more pre-reactors and said pre-reactors are operated in parallel and said parallel pre-reactors are operated at essentially similar conditions and/or with essentially similar materials so as to produce catalyst particles of essentially similar sizes, compositions, concentrations, states and/or morphologies or said parallel pre-reactors are operated at different conditions and/or with different materials and/or methods so as to produce catalyst particles of two or more distinct sizes, compositions, concentrations, states and/or morphologies.

78. (currently amended) [[An]] The apparatus according to claim 72, characterised in that wherein said reactors are operated in parallel and said parallel reactors are operated at essentially similar conditions and/or with essentially similar materials so as to produce carbon nanotubes with essentially similar length, diameter, morphology and/or chirality or said parallel reactors are operated at different conditions and/or with different materials and/or methods so as to produce carbon nanotubes with two or more distinct lengths, diameters, morphologies and/or chiralities.

79. (currently amended) [[An]] The apparatus according to claim 72, characterised in that wherein the reactor length, volume and/or wall temperature and/or the flow rate of

carbon sources and/or reagents and/or carrier gases are used
configured to control the residence time and/or temperature
history of catalyst particles and/or carbon nanotubes and/or
composite carbon nanotubes in the reactor(s) and/or pre-
reactor(s).

80-91. (canceled)